5 ANL-01 DITCH B

This section discusses information specific to work that will be performed during the remediation to the open portion of release site ANL-01 Ditch B. The buried portion of ANL-01 Ditch B does not pose unacceptable risks to the ecological receptors. The open portion of ANL-01 Ditch B contains inorganics that would take longer than 10 years to meet the remediation goals using phytoremediation. Thus, this site will be remediated using the contingent remedy of excavation with on-INEEL disposal. The necessary tasks to successfully complete the excavation and disposal of ANL-01 Ditch B are described in this section. Remediation has been subdivided into major tasks associated with the preexcavation, excavation, transportation, and verification sampling associated with the ANL-01 Ditch B site. Generic activities that are common to all sites being remediated at ANL-W (such as the Health and Safety Plan and the Quality Assurance Project Plan) can be found in the appendices.

5.1 History of Site

The location of Ditch B with respect to ANL-W is shown in Figure 1-3. Initially, Ditch B was used to transport storm-water runoff as well as wastewater from the EBR-II Power Plant and the Fire Station (Bldgs. 768 and 759) to the Industrial Waste Pond. Only a small, 125-ft long portion of Ditch B is still being used today since the majority 1,275 ft of Ditch B was backfilled with clean soil to grade by adding approximately 5 ft of fill material during installation of a secondary security fence.

5.2 Contaminants

Soil samples were collected from Ditch B as part of three different investigations. Six soil samples were collected from the 1988 DOE study, 15 samples from the 1988 Chen-Northern study, and 10 samples from the 1994 ANL-W study. Appendix A of *OU 9-04 Comprehensive RI/FS* shows the sampling-location plan map, color-intensity profile maps, and statistics for COC by pathway for the 1994 samples collected from Ditch B. The contaminant screening resulted in no unacceptable risks to humans and only two inorganics that posed unacceptable risks to the ecological receptors. These two inorganic contaminants are trivalent chromium and zinc.

The maximum concentration of trivalent chromium and zinc are 4,530 and 3,020 mg/kg; the UCL concentrations are 1,306 and 1,460 mg/kg, respectively. The extent of the inorganic contaminants span the entire length of the open portion of Ditch B and is at most 5 ft wide and 125 ft long. No stratification of inorganics was determined from the results in that portion of Ditch B and thus the total depth of the alluvium to the basalt. The depth to basalt is irregular but on average is approximately 1.3 ft deep.

5.3 Receptors of Concern

Chromium poses an unacceptable ecological risk to numerous plants, while the zinc concentrations pose ecological risks with functional group AV 232 with the Red-Wing Blackbird as a common species. Both chromium and zinc pose unacceptable risks for the surface contaminants in the still-open portion of Ditch B. The contaminants in the covered portion of Ditch B have been screened from the risk assessment since the pathway was eliminated when the area was backfilled with clean soils during the security-fence upgrade.

5.4 Remediation Goals

As stated in the WAG 9 ROD, the established remediation goals for chromium and zinc in Ditch B are 500 and 2,200 mg/kg, respectively. These levels were calculated at 10 times the INEEL background concentration for chromium and zinc. Chromium and zinc posed only unacceptable ecological risks at the Ditch B site. The remediation of Ditch B will be completed to remove these contaminants to levels that will not pose unacceptable ecological risks.

5.5 Preexcavation Activities

Preexcavation activities involve creating a paper-trail documentation record of analytical results of past sampling. Previous sampling results will be copied from *WAG 9-04 Comprehensive RI/FS* and attached as supplemental information to the required INEEL managing contractor's documentation packages. The soil from ANL-01 Ditch B will be shipped to the CFA Landfill Complex as a conditional waste. The specification for conditional wastes are found in the INEEL RRWAC Section 4.3.2. ANL-W will follow internal instructions in accordance with item 6.3 of Section 3.1 *ANL-W Environment, Safety, and Health Manual,* for shipment of radioactive and nonradioactive items of equipment material and hazardous wastes. ANL-W will also submit the appropriate forms to the INEEL managing contractor and receive signed concurrence prior to shipment. The necessary forms are described in the following paragraph.

The INEEL managing site contractor waste characterization forms (L-435.10 through L-435.13), along with the Solid Waste Log Form (L-103), and Technical Procedure (713) will be completed and submitted to the site contractor to show that no DOE radioactive contamination has been added to the soils. These INEEL managing site contractor will review these forms and upon concurrance the Ditch B soils can be shipped. ANL-W anticipates that the review and concurrence by the managing site contractor will take two weeks. However, ANL-W will send the forms approximately one month prior to the planned shipping date to allow for any unforseen delays.

5.6 Excavation Activities

The extent of contamination in Ditch B was determined (in the RI/FS) to be a maximum of 125 ft long, 5 ft wide, and 1.3 ft deep. The lateral extent of contamination consisted of the wetted area along the ditch bottom with no lateral movement of contaminants. The contamination was fairly homogeneously distributed vertically from the surface to the basalt. The volume of soil that will be removed has been estimated to be approximately 812.5 ft^3 or 30 yd^3. The excavation will be initiated utilizing a combination of heavy equipment and manual labor. A majority of the contaminated soil can be removed using a front-end loader and dump trucks. However, because of the irregular top surface of the basalt, manual labor will be utilized to remove the soil that the heavy equipment cannot remove. ANL-W anticipates manual labor will also be used to remove the soil near the drainage culverts .

The first step in the soil excavation in Ditch B will be to mark all existing underground utilities (such as fire-hydrant supply lines, water supply lines, sewer lines, buried electrical lines, overhead power lines, cathodic protection lines, and security warning devices) within 50 ft of the contaminated zone. This will be accomplished by using existing site drawings and onsite inspections by key Plant Services personnel and safety engineers. ANL-W will complete the digging/excavation permit in accordance with Section 4.4H of the *ANL-W Environment, Safety, and Health Manual.* Temporary stands will be spaced approximately 50 ft apart around the Ditch B to set up a contaminant reduction zone. The temporary stands will have ring hangers approximately three ft off the ground that will be used to string a yellow and black poly rope between the stands. Signs will be attached to the rope warning people that only authorized personnel are allowed in the contaminant reduction zone. The surface of Ditch B will be wetted using a garden hose and sprayer attachment to control dust during excavation activities. Watering should take approximately 10 minutes at each location along the ditch.

Prior to initiating the remediation effort at Ditch B, a safety meeting will be held for all workers to define the hazards associated with the removal action. The workers will be dressed in Occupational Safety and Health Administration (OSHA) level-D personnel protective equipment (PPE). As a minimum the PPE will consist of leather shoes, leather gloves, safety glasses, hardhats, and coveralls. In addition, there will be no eating, drinking, smoking, or gum chewing in the contaminant reduction zone.

The initial excavation of soil will be conducted using the front-end loader and dump truck. A laborer will assist the front-end-loader operator in use and control of the bucket. The excavated material will be placed in the dump truck stationed close to Ditch B. This process will be repeated until the front-end loader has excavated as much soil as possible from the contaminated ditch. The laborers will then use shovels to manually remove the remaining soil from the ditch and place it into the front-end-loader bucket. The laborers will then use shovels and brooms to remove as much soil as possible from the top of basalt in the ditch bottom. The front-end loader will dispose of this material in the dump truck as needed.

When a dump truck has been filled, it will be carefully inspected to remove any additional material accidentally deposited on the outside of the truck box. Any soil removed from the truck will be added to the dump truck. The dump truck will be driven out of the contaminated zone over to building 783, where a tarpaulin cover will be attached to prevent loss of material during transit. Officials at the CFA Landfill Complex will be notified of a pending shipment; completed documentation will accompany the shipment. When the dump truck returns to ANL-W, the truck will be used to remove additional soil from Ditch B. When all soil has been shipped or prior to the dump truck being used for other non-CERCLA jobs, the dump truck must be washed at the cooling tower decontamination wash pad.

The cooling tower decontamination wash pad consists of a concrete bermed area that is sloped to a centralized drain. A high pressure washer will be used, along with shovels and brooms, to remove all the ditch soil from the truck. Large debris and/or material that is firmly attached to the truck can be removed using a shovel or a scrub brush. After washing the dump truck, it will be moved off the washpad and moved to building 783. The laborers will wash the scrub brushes, shovels, brooms, and other equipment used in Ditch B using the high-pressure washer. These tools will be air dried and returned to the tool crib. Laborers will also use the high pressure washer to clean the wash pad of all soil residue. The decontamination procedure is included in the ANL-W Environmental Procedure Manual and referenced in Appendix C (Quality Assurance Project Plan). A sample of the wash-pad water will be collected from the storage tank and analyzed.

When analysis results for the decontamination water are received, a determination as to final disposition will be made. If the decontamination water contains no RCRA wastes, the water will either be pumped into Ditch A or pumped into the evaporation holding tank next to the wash pad. However, if the decontamination water contains hazardous waster, it will be managed in accordance with the substantive aspects of IDAPA 16.01.05008 (Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities). The wastes would be pumped into 55-gal drums and transferred to an ANL-W cargo container, pending disposal in accordance with task 6.3 of Section 3.1 Shipment of Radioactive and Nonradioactive Items of Equipment, Material, and Hazardous Wastes of the *ANL-W Environment, Safety, and Health Manual..*

5.7 Verification Sampling

Verification samples are typically collected after the site has been remediated to show that remediation goals established in the ROD have been attained. However, validation sampling cannot be completed at the Ditch B site after the contaminated soil has been removed. The contaminated zone in Ditch B has been defined as the soil in the ditch to the top of the basalt. The soil on top of the basalt will be removed, leaving only small volumes of soil that are in cracks and fissures of the basalt remaining. The small volumes of soil that remain can't be sampled and used as verification samples because the soil structure and concentrations are different from the surface loess. Thus, completely removing the soil in Ditch B and documenting the removal with photographs satisfies the verification sampling requirement.

5.8 Regrading

After the soil has been removed to basalt and documented, clean backfill material can be added to Ditch B. This clean backfill material will be trucked to ANL-W from the borrow pit located 2 miles Northwest of ANL-W. The backfill material will be applied in approximately 4 in. deep lifts, and compacted using the tires and weight of the front-end loader and gas-powered hand tampers around the culverts. Soil application will continue until the ditch-bottom grade is above the % grade line running between the culverts. A scraper will be utilized to blade the bottom and side-slopes of the ditch to its original shape.

5.9 Revegetation

Revegetation of this ditch will not be conducted. This ditch carries both industrial waste water and storm water runoff and will continue to be used for these purposes.

6 ANL-01A MAIN COOLING TOWER BLOWDOWN DITCH

This section discusses information specific to release site ANL-01A Main Cooling Tower Blowdown Ditch and the work that will be performed during remediation. The Main Cooling Tower Blowdown Ditch has been subdivided into two sections— the east portion inside the security fences and west portion in between the security fences. The east portion and west portion of the Main Cooling Tower Blowdown Ditch contain the same history, contaminants, and remediation goals, but have been separated for remediation methodologies. The east portion of the Main Cooling Tower Blowdown Ditch received discharges from the Cooling Tower and contains contaminants throughout the entire length at concentrations that prevent successful phytoremediation. The west portion of the Main Cooling Tower Blowdown Ditch is further downstream and contaminants are nonhomogeneous along the length and depth with levels of contaminants within those that can be phytoremediated. Section 6.4 discusses the tasks associated with excavation and disposal of the east portion; Section 6.5 discusses the phytoremediation of the west portion. Generic activities that are common to all sites being remediated at ANL-W (such as the Health and Safety Plan and Quality Assurance Project Plan) can be found in the appendices.

6.1 History of Site

The location of the Main Cooling Tower Blowdown Ditch, with respect to ANL-W is shown in Figure 1-3. The Main Cooling Tower Blowdown Ditch runs north on the westside of the Main Cooling Tower and then north between the security fences to the Industrial Waste Pond. It is an unlined channel approximately 700 ft in length and 3 to 15 ft wide. From 1962 to 1996, the ditch was utilized to convey industrial waste water from the Cooling Tower to the Industrial Waste Pond. The main source of impurities to the Industrial Waste Pond were water treatment chemicals (used for the regeneration of backwash waters from the ion exchange resin beds) and removed minerals from cooling tower water used in the EBR-II steam system. From 1962 to July 1980, a chromate-based corrosion inhibitor was added to the Cooling Tower water and the blowdown contained significant quantities of hexavalent chromium. Ion-exchange-column-regeneration discharges occurred from 1962 to March 1986; column regeneration was accomplished using sulfuric acid for cation columns and sodium hydroxide for anion columns.

In January 1986, a pH measurement of 1.86 was measured in the effluent discharged to the Main Cooling Tower Blowdown Ditch, which classified the liquid wastes as corrosive according to 40 CFR 261.22. The site was then classified as a Land Disposal Unit under RCRA. A temporary neutralization system was installed in March, and a permanent neutralization tank was installed in October 1986. A few discharges of regeneration water occurred, but they were in small batches and were monitored before discharge. Since October 1986 (after the neutralization tank was installed), reagents have been neutralized in a tank prior to discharge to the ditch. DOE, along with EPA and IDHW WAG 9 managers, have determined that the Main Cooling Tower Blowdown Ditch is a RCRA Land Disposal Unit and will be remediated under the CERCLA process [in accordance with the applicable substantive requirements of RCRA/Hazardous Waste Management Act (HWMA)], if an unacceptable risk to human health or the environment is identified. However, the FFA/CO has only adopted RCRA corrective actions (3004 (u) & (v)), and not RCRA/HWMA closure. Therefore, upon completion of the remedial action, DOE must receive approval from the IDHW Department of Environmental Quality Director to close the Main Cooling Tower Blowdown Ditch pursuant to RCRA/HWMA closure requirements.

6.2 Contaminants

Appendix A of the OU 9-04 Comprehensive RI/FS shows the sampling location plan map, color intensity profile maps, and statistics for contaminants by pathway for samples collected from the Main Cooling Tower Blowdown Ditch. Soil samples were collected from the Main Cooling Tower Blowdown Ditch as part of four different investigations occurring from 1987, 1988, 1989, and 1994. The contaminant screening resulted in two inorganics, trivalent chromium, and mercury at levels high enough to be retained as contaminants that posed unacceptable risks to the ecological receptors. Chromium has unacceptable risks to numerous plants, while mercury has an unacceptable risk to the functional group (M222) with common species Merriams shrew.

Chromium concentrations were the highest in the outfall from the Cooling Tower. But, the entire length of the Main Cooling Tower Blowdown Ditch has concentrations of chromium above the 95% UCL background concentration levels for the INEEL surface soils. Analysis performed on the chromium was for the total chromium analysis. Prior to July, 1980, EBR-II discharged hexavalent chromium waters to the Main Cooling Tower Blowdown Ditch, although an attempt was made to reduce the hexavalent to trivalent chromium using sulfur dioxide, sample analysis always disclosed trace quantities of hexavalent chromium in the water. But, to be conservative, DOE assumed that 10 percent of the total chromium would be in the more toxic hexavalent form. The chromium concentrations almost exclusively decreased with increasing depth, and also decreased with increasing distance downstream of the cooling tower outfall. The maximum chromium concentration was 2,200 mg/kg and the UCL concentration was 1,306 mg/kg for the Main Cooling Tower Blowdown Ditch.

Forty-eight percent (22/46) of the mercury concentrations exceeded the upper limit of the 95% UCL background concentration (0.074 mg/kg) ranging from 0.08–13.4 mg/kg. The highest detected concentration was from the surface sample at location 9E. Mercury concentrations were highest in the eastern part of the ditch and typically decreased to less than 1 mg/kg in the subsurface samples except for one location. At location 11E, mercury concentrations were 2.8 mg/kg in the surface and 2.3 mg/kg in the subsurface sample. The maximum mercury concentration was 13.4 mg/kg and the UCL concentration was 8.83 mg/kg for the surface soils in the Main Cooling Tower Blowdown Ditch.

The extent of the contamination is mainly concentrated in the east portion of the ditch near the cooling tower outfall. However, there are some concentrations greater than the upper limit of the 95% UCL background concentration for some metals in the west portion of the ditch. Therefore, the horizontal extent of contamination is the dimensions of both the east and west portions of the Main Cooling Tower Blowdown Ditch 3 to 15 ft wide and 700 ft long. Because the width of the ditch varies from 3 to 15 ft, an average width of 6 ft will be used. The majority of the inorganic contaminants were concentrated in the top 6 in. of soil. However, some detections greater than the upper limit of the 95% UCL background concentration were made in some subsurface samples. Therefore, the vertical extent of contamination is assumed to be one-half the average depth to basalt 2 ft. The Main Cooling Tower Blowdown Ditch conveyed industrial wastewater from the EBR-II Cooling Tower to the Industrial Waste Pond. The Main Cooling Tower Blowdown Ditch is still being used today to transport storm-water, runoff as well as intermittent auxiliary industrial discharges to the Industrial Waste Pond. The mercury contamination is most likely the result of slight concentrations in the acid used to regenerate the ion beds in the EBR-II Power Plant.

6.3 Remediation Goals

The established remediation goals for the chromium and mercury are identified in the WAG 9 ROD as 500 and 0.74 mg/kg, respectfully. Both remediation-goal concentrations were calculated at 10 times the INEEL background concentration.

6.4 Excavation and Disposal (East Portion)

The east portion of the Main Cooling Tower Blowdown Ditch will undergo excavation and disposal to remediate the site to meet remediation goals. The soils in the east portion contain contaminants at concentrations that cannot be effectively remediated. The work to be completed to excavate and dispose of the soils in the east portion of the Main Cooling Tower Blowdown Ditch is discussed in the following subsections.

6.4.1 Preexcavation Activities

The preexcavation activities will involve creating a paper-trail documentation record of analytical results of past sampling. Previous sampling results will be copied from *WAG 9-04 Comprehensive RI/FS* and attached as supplemental information to the required INEEL-managing-contractor's documentation packages. Soil from the east portion of the Main Cooling Tower Blowdown Ditch will be shipped to the CFA Landfill Complex as conditional waste. The specifications for conditional wastes are found in the INEEL RRWAC Section 4.3.2. ANL-W will follow internal instructions in accordance with subsection 6.3 of Section 3.1 Shipment of Radioactive and Nonradioactive Items of Equipment, Material, and Hazardous Wastes of the *ANL-W Environmental Safety and Health Manual*. ANL-W will also submit the appropriate forms to the INEEL managing contractor and receive signed concurrence prior to shipment. The necessary forms are described below.

The INEEL-managing-contractor Waste Characterization Forms (L-435.10 through L-435.13), along with Solid Waste Log form (L-103), and a completed Technical Procedure (713), which includes calculations that show that no DOE radioactive contamination has been added to the soils, will be completed and submitted together as complete package for the east portion of the Main Cooling Tower Blowdown Ditch. After receipt of the completed documentation package, review and concurrence by the INEEL-managing-contractor typically takes two weeks to complete. However, ANL-W will send the forms approximately one month prior to the planned shipping date to allow for any unforseen delays.

6.4.2 Excavation Activities

The extent of contamination in the east portion of the Main Cooling Tower Blowdown Ditch is the area inside the banks of the ditch from the surface to the top of basalt. The east portion of the Main Cooling Tower Blowdown Ditch is 150 ft long, 6 ft wide, and 2 ft deep. The volume of soil that will be removed has been estimated to be approximately 1,800 ft^3 or 66 yd^3. The lateral extent of contamination consisted of the wetted area along the ditch bottom with no contaminant concentrations decreasing along the length from outfall. The contamination was fairly homogeneously distributed vertically from the surface to the basalt. The excavation will be initiated utilizing a combination of heavy equipment and manual labor. A majority of the contaminated soil can be removed using a front-end loader and dump trucks. However, because of the irregular top surface of the basalt, manual labor will be utilized to remove the soil that the heavy equipment cannot remove. ANL-W anticipates manual labor will also be used to remove the soil near the drainage culverts .

The first step in the soil excavation will be to mark all existing underground utilities (such as fire-hydrant supply lines, water supply lines, sewer lines, buried electrical lines, overhead power lines, cathodic protection lines, and security warning devises) within 50 ft of the contaminated zone. This will be accomplished by using existing site drawings and onsite inspections by key Plant Services personnel and safety engineers. ANL-W will complete the digging/excavation permit in accordance with Section 4.4H of the *ANL-W Environment, Safety, and Health Manual.* Temporary stands will be spaced approximately 50 ft apart around Ditch B to set up a contaminant reduction zone. The east edge of the road will be used as the western marker for the warning signs. The temporary stands will have ring hangers approximately 3 ft off the ground that will be used to string a yellow and black poly rope between the stands. Signs will be attached to the rope warning people that only authorized personnel are allowed in the contaminant reduction zone. The surface soils will be wetted using a garden hose and sprayer attachment to control dust during excavation activities. Watering and rewatering will occur whenever the exposed surface is dry and susceptible to wind erosion.

Prior to initiating the remediation effort at Ditch B, a safety meeting will be held for all workers to define the hazards associated with the removal action. The workers will be dressed in OSHA level-D PPE. As a minimum the PPE will consist of leather shoes, leather gloves, safety glasses, hardhats, and coveralls. In addition, there will be no eating, drinking, smoking, or gum chewing in the contaminant reduction zone.

The initial excavation of soil will be conducted using the front-end loader and the dump truck. A laborer will assist the front-end loader operator in the use and control of the bucket. The excavated material will be placed in the dump truck stationed on the road just west of the ditch. This process will be repeated until the front-end loader has excavated as much soil as possible from the contaminated ditch. The laborers will then use shovels to manually remove the remaining soil in the ditch and place it into the front-end-loader-bucket. The laborers will then use shovels and brooms to remove as much soil as possible from the top of basalt in the ditch bottom. The front-end loader will dispose of this material in the dump truck as needed.

When a dump truck has been filled, it will be carefully inspected to remove any additional material accidently deposited on the outside of the truck box. Any soil removed from the truck will be added to the dump truck. The dump truck will be driven out of the contaminated zone over to building 783, where a tarpaulin cover will be attached to prevent loss of material during transit. Officials at the CFA Landfill Complex will be notified of a pending shipment; completed documentation will accompany the shipment. When the dump truck returns to ANL-W, the truck will be used to remove additional soil from the east portion of the Main Cooling Tower Blowdown Ditch. When all soil has been shipped or prior to the dump truck being used for other non-CERCLA jobs, the truck must be washed at the cooling tower decontamination wash pad.

The cooling tower decontamination wash pad consists of a concrete bermed area that is sloped to a centralized drain. A high pressure washer will be used, along with shovels and brooms, to remove all the ditch soil from the truck. Large debris and/or material that is firmly attached to the truck can be removed using a shovel or a scrub brush. After washing the dump truck, the dump truck will be moved off the washpad and moved to building 783. The laborers will wash the scrub brushes, shovels, brooms, and other equipment used with the high pressure washer. These tools will then be air dried and returned to the tool crib. Laborers will also use the high-pressure washer to clean the wash pad of all soil residue. The decontamination procedure is in the ANL-W Environmental Procedure Manual and referenced in

Appendix C (Quality Assurance Project Plan). A sample of the wash-pad water will be collected from the storage tank and analyzed.

When analysis results for the decontamination water are received the determination as to final disposition will be made. If the decontamination water contains no RCRA wastes, the water will either be pumped into Ditch A or pumped into the evaporation holding tank next to the wash pad. However, if the decontamination water contains hazardous wastes, the decontamination water will be pumped into 55 gallon drums and transferred to an ANL-W cargo container pending disposal in accordance with task 6.3 of Section 3.1 Shipment of Radioactive and Nonradioactive Items of Equipment Material and Hazardous Wastes of the *ANL-W Environment, Safety, and Health Manual.*

6.4.3 Verification Sampling

Verification samples are typically collected after the site has been remediated to show that the remediation goals established in the ROD have been attained. However, validation sampling cannot be completed for the east portion of the Main Cooling Tower Blowdown Ditch site after all of the contaminated soil has been removed. The contaminated zone has been defined as all the soil within the ditch banks to the top of the basalt. The soil above the top of the basalt will be removed, leaving only small volumes of soil that are in cracks and fissures of the basalt remaining. The small volumes of soil that remain can't be sampled and used as verification samples because the soil structure and concentrations are different from the surface loess. Thus, completely removing the soil in the east portion of the Main Cooling Tower Blowdown Ditch and documenting the removal with photographs satisfies the verification sampling requirement.

6.4.4 Regrading

After the soil has been removed to basalt and documented, clean backfill material can be added to the east portion of the Main Cooling Tower Blowdown Ditch. This clean backfill material will be trucked to ANL-W from the borrow pit located 2 miles northwest of ANL-W. The backfill material will be applied in approximately 4 in. deep lifts, and compacted using the tires and weight of the front-end loader and gas-powered hand tampers around the culverts. Soil application will continue until the ditch-bottom grade is above the grade line running between the culverts. A scraper will be utilized to blade the bottom and side-slopes of the ditch to its original shape.

6.4.5 Revegetation

Revegetation of this ditch will not be conducted. This ditch carries both industrial waste water and storm water runoff and will continue to do so into the future.

6.5 Phytoremediation (west portion)

The west portion of the Main Cooling Tower Blowdown Ditch has contaminants at varying concentrations and locations that can be effectively remediated using phytoremediation. The following subsection describes the activities associated with implementation of phytoremediation of the west portion of the Main Cooling Tower Blowdown Ditch.

6.5.1 Preplanting Activities

Preplanting activities will occur once prior to the initial growing season in accordance with the working schedule shown in Appendix F. Pre-planting activities will involve grubbing of currently existing vegetation, grading, removing rock, installing irrigation lines, fences and signs (where necessary). Each of the activities specific to phytoremediation of soils in the west portion of the Main Cooling Tower Blowdown Ditch are discussed below in further detail.

6.5.2 Grubbing Activities

The west portion of the Main Cooling Tower Blowdown Ditch currently contains dead cattails and reeds stalks from previous years' growth. These plant remnants have been knocked down to the bottom of the ditch by the winter snows. Some of the cattails and reeds may be excavated, surveyed, analyzed, and disposed with soils from the west portion of the Main Cooling Tower Blowdown Ditch. The removed vegetation will be sampled for total metals and if the results indicate that the contaminants could fail the TCLP levels, the TCLP analysis will also be performed. If the wastes fail the TCLP analysis for any of the inorganic contaminants, the soils will be disposed in an approved Treatment Storage and Disposal Facility.

6.5.3 Grading Activities

The west portion of the Main Cooling Tower Blowdown Ditch is currently used to convey surface-water runoff, as well as industrial waste water discharges. The Main Cooling Tower Blowdown Ditch currently contains rebar with caps that identify the 1994 sampling locations. A global positioning system will be used to permently identify these past sample locations. A grader and a small front-end loader will be used to slope at approximately a three-for-one foot grade to allow for equipment access. Cross-sectional view of the west portion of the Main Cooling Tower Blowdown Ditch is shown in Appendix A.

6.5.4 Rock Removal

Any rock that is bigger than a cobble (2-3 in.) will be removed manually using a steel rake prior to planting. These rocks are not native to this area and have been used as ground cover over these open areas. Over time, the rocks have been dislodged and are now located in the ditch bottom. The rocks will have no contamination on their outer surfaces and will be placed on the outer edges of the ditch banks.

6.5.5 Irrigation-Line Installation

Current water discharges are intermittent with discharges up to 15 gallons per minute. The water infiltrates the soil within the first 100 ft of ditch in between the fences. The furthest extent of the water down the ditch can be seen by visual inspection of the cattails and reeds. There is a distinct line between the green plants which receive water and the brown dead plants that do not receive water. Thus, phytoremediation will require additional water to fully optimize the removal efficiencies of the willow. To accomplish this, ANL-W will use supplemental irrigation to water the west portion of the Main Cooling Tower Blowdown Ditch. The irrigation system has been designed to allow for automatic watering with a manual override to either stop or start watering. The system will use untreated groundwater in the ANL-W fire suppression system as the water source and have all distribution lines originating in a centralized location near the ANL-W Cooling Tower. (A schematic of the distribution system is shown in Appendix A.) The plan map shows the location of and specifications for the irrigation system for Ditch A. The distribution lines will be located on the top of the south and west ditch banks. This will allow for minimal wind drift losses from the typical southwesterly winds. The irrigation heads will be commercially-available home sprinkler lines and be fully adjustable from 0-180 degrees with a range out to 15 ft. The heads will be placed on risers with Nelson 30-lb pressure regulators to keep water rates consistent between the irrigation heads. Each head will be spaced 15 ft apart to allow for double coverage with each head. The irrigation line will be commercially available 2-in. poly line. Saddles will be inserted into the poly line at the desired sprinkle-head location. A threaded riser will be screwed into the saddle and regulator; then the sprinkler head will be attached. The risers will be anchored into the soil to prevent the wind from knocking them over. The irrigation line will be slightly trenched into the ditch bank to minimize rotational movement and reduce the tripping hazard.

6.5.6 Barrier Installation

The west portion of the Main Cooling Tower Blowdown Ditch is located in between the ANL-W security fences. Additional fencing around this site is not necessary to prevent human intrudance. Ecological receptors that could potentially gain access to this area are small mammals, insects, and birds. The small localized population exposure to these areas during the phytoremediation activities will not have any detrimental effect to the population of these animals on the INEEL, Eastern Idaho, or Idaho. Signs will be placed on fences around the west portion of the Main Cooling Tower Blowdown Ditch that identify the area as a CERCLA site undergoing phytoremediation and identify a point of contact. The signs will be placed approximately every 50 ft along the ditch banks.

6.5.7 Planting Activities

This site will be planted with 3 ft tall, bare-root willow plants in a grid pattern, as shown in Appendix A. The bare-root willow will be spaced approximately 18 in. on center to optimize the biomass of the plant at the end of the field season. The holes for the trees will either be made manually using a spade or hydraulically driven auger mounted on a boom. The holes will be excavated to approximately 12 in. into the soil to allow for complete planing of the willow roots. The soils will be placed back into the hole and lightly tampped. Water will be added to allow for settling of soil around the roots and to reduce the amount of void space. This procedure will be repeated until all willows have been planted in accordance with the plan map (shown in Appendix A). Where the tractor can not reach a planting location, a willow tree will be manually planted using a shovel to dig the hole.

If subsurface rock is encountered, the hole location can be moved toward the center of the ditch. The center of the ditch contains the contamination; keeping the plants closest to the ditch center maximizes the potential for contaminant removal. It is important to try to complete the planting as close as possible to the grid to limit the potential for stunting plant growth, which will reduce the biomass produced and ultimately the contaminant removal.

If basalt is encountered before the planting depth of 14 in. is reached, the plant can still be planted as long as the sois is deeper than six in. A larger hole may have to be manually dug to allow the root ball to be spiraled into the hole. If the soil is less than 6 in. deep, the next grid location will be planted.

6.5.8 Irrigation and Amendments

To optimize the biomass of the willow plants, supplemental irrigation will be installed to keep the soil moisture content between 40-50 % in the contaminated zone. Calibration of the moisture detectors along with the moisture content set point adjustments will be made in the field with the ANL-W soils. The system can be adjusted to optimize the moisture content needed by the plants to the actual site being remediated. To accomplish this, moisture detectors will be installed that will automatically turn on or shut off the irrigation system when the soil moisture varies outside these levels. Two moisture detectors will be stacked vertically at depths of 1.0 and 1.5 ft. An automatic watering switch will be installed on the detector located at the 1.0 ft depth. This will "train" the willow plant roots to stay within the contaminated zone as they seek out the water. The lower moisture detector will be used to verify that irrigation has not leached the contaminants below the contaminated zone.

Appendix A contains a map that shows the schematic of the zonal-type irrigation system that will be employed at ANL-W. The system will allow each of the remedial sites at ANL-W to operate individually, based on individual water needs. The system can be manually overridden if it is determined that more or less water is required for an individual site. As shown in the distribution-system manifold figure shown in Appendix A, a pressure reducer and chemical injection system have been installed prior to the distribution lines. This will allow ANL-W to add soil amendments [such as fertilizers and or extractants (EDTA and/or citric acid)] to each of the waste sites through the irrigation system. Nutrient analysis of the soils will be tested periodically and the necessary fertilizers will be applied to meet the needs of the plants through their growing season. The chemical injection system will only be operated after the root zone fully covers the contaminated area and then only in the manual mode.

6.5.9 Harvesting Activities

Harvesting of the willows will be accomplished by first reducing the moisture of the soil to less than 30%. The moisture detectors in the soil will then be manually removed from the soil. The irrigation system will then be manually operated and run for 5 minutes. (This will wet the area and act as a dust suppressant while the harvesting activities are being conducted.)

Harvesting of the willows will be accomplished using a front-end loader mounted on a small tractor. A hydraulically-controlled implement will be installed on the front-end loader. The tractor will drive down the ditch; and as the trunks of the trees get wedged into the attachment, the loader can be raised to remove the tree root from the ground. Once the root is removed from the soil, the operator will then use the hydraulic ram to cut the willow trunk into two pieces. Another worker will take the top portion of the willow tree and replant it, while the root portion will be feed into the wood chipper. The chipped pieces of wood will then funnel into 2-ft square cardboard boxes. When the boxes are full, they will be labeled, surveyed, and staged in a cargo container to await shipment to the WERF incinerator. This process will continue until all willow plants have been removed from the soil.

6.5.10 Postharvesting Activities

After all willow plants have been harvested, postharvesting activities will be initiated, which includes regrading the soils back to the original preplanting cross-sectional requirements shown in Appendix A. The irrigation line will be turned off at the fire hydrant and the distribution line pressurized to 50 psi using a portable Sulair compressor. Each of the distribution lines will be manually activated to blow the water from the irrigation line. This will be completed for each distribution line to prevent water from breaking lines during the winter.

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7 ANL-09 INTERCEPTOR CANAL-MOUND

This section discusses information specific to the Interceptor Canal-Mound and the work that will be performed during remediation. The necessary work has been subdivided into major tasks associated with the preplanting, planting, irrigating, harvesting, and postharvesting activities specific to the Interceptor Canal-Mound. Generic activities that are common to all sites being remediated at ANL-W (such as the Health and Safety Plan and the Quality Assurance Project Plan) can be found in the appendices.

7.1 History of Site

The location of the Interceptor Canal-Mound with respect to ANL-W is shown in Figure 1-3.

7.2 Contaminants

This section summarizes analytical results for soil samples collected at the Interceptor Canal-Mound area. The Interceptor Canal-Mound was formed when 1,384 m^3 (1,810 yd^3) of dredged material was placed on the bank of the Interceptor Canal. Soil samples from the Interceptor Cana- Mound were only analyzed for radionuclides. Inorganic releases to the Interceptor Canal-Canal occurred after the canal was dredged and, therefore, would not be in the dredged piles. Surface soil samples (0 to 6 in.) and a subsurface soil sample (approximately 3 to 4 ft) were collected at the ANL-09-Mound area. In addition, another subsurface soil sample was collected (approximately 5 to 6 ft) at three sample locations (#356, #368, and #378). Subsurface soil samples were collected at depths that correspond to the bottom of the mound. The deeper subsurface samples were collected to determine if migration of contaminants had occurred. The contaminant screening resulted in only one radionuclide (cesium-137) being retained as a contaminant for humans; no contaminants were retained for remediation for ecological receptors.

The cesium-137 was detected at every sample location throughout the mound, with the highest detected concentration (52 pCi/g) at location M19, while the UCL concentration for the cesium-137 was 30.53 pCi/g. Therefore, the horizontal extent of the cesium-137 is defined as the entire length of the mound (500 × 20 ft). For the vertical extent of the cesium-137 contamination, there is a significant decrease in concentrations (approximately one order of magnitude) between the surface and subsurface samples. The maximum detected cesium-137 concentration in the subsurface sample was only 5.9 pCi/g. Nevertheless, as this concentration is above the established background, the vertical extent of contamination is 4 ft.

7.3 Remediation Goal

The established remediation goal for the Interceptor Canal-Mound cesium-137 contamination is identified in the WAG 9 ROD as 23.3 pCi/g. This 23.3 pCi/g remediation goal activity level will naturally decay to acceptable activity level after 100 years. Thus, this site will require institutional controls as part of the remediation because these cleanup levels will not allow for unrestricted land use. This site, along with the Industrial Waste Pond and the Interceptor Canal-Canal, make up the three sites at ANL-W that will comply with the Operations and Maintenance Plan (O&M) (as shown in Appendix B). All other sites are being remediated to levels that will allow unrestricted land use and will not have to comply with the O&M Plan.

7.4 Preplanting Activities

Pre-planting activities will occur once, prior to the initial growing season at the Interceptor Canal-Mound and involve grubbing of currently existing vegetation, grading, removing rock, installing irrigation lines, fences, and signs (where necessary). Each of these activities specific to Interceptor Canal-Mound are discussed below in further detail.

7.4.1 Grubbing Activities

The Interceptor Canal-Mound currently contains relatively few weeds growing on the dredged mound piles. To the maximum extent possible, old plant stalks from previous years, along with new plant growth will be retilled into the soil and used as organic material in the soil.

7.4.2 Grading Activities

The Interceptor Canal-Mound contains irregular mounds along the bank of the Interceptor Canal. These mounds vary in width and depth along the length of the site. To facilitate growing plants in a controlled and engineered methodology that optimizes exposure of the cesium-soil-root interphase, the mounds will be graded to form a rectangular plot approximately 2 ft thick. The grading activity will consist of using a blade on a road grader to feather the soil from the south and east end to the north and west. The grader operator will try to the maximum extent possible, to form an area approximately 40 ft wide, 500 ft long, and 2 ft or less thick. The surface of this area will be sloped approximately 2-4% to the west to prevent ponding water between the Interceptor Canal ditch banks and the area undergoing phytoremediation. (A cross-sectional view of Interceptor Canal-Mound site after grading has been completed is shown in Appendix A).

7.4.3 Rock Removal

Any lava rock that is bigger than a cobble (2-3 in.) will be removed prior to planting. These lava rocks are located toward the north end of the phytoremediation plot where explosives were used to remove lava rock from the bottom of the Interceptor Canal. The lava rock was removed from the bottom of the Interceptor Canal and placed on the Mound area to facilitate water drainage to the Industrial Waste Pond. The lava rock will be manually removed by laborers using a small utility trailer. The rocks do not have any contamination on their outer surface and will be placed on top of the old Interceptor Canal ditch bank.

7.4.4 Irrigation-Line Installation

The phytoremediation of the Interceptor Canal-Mound will require additional water to fully optimize the removal efficiencies of the koshia. To accomplish this, ANL-W will use supplemental irrigation to water the Interceptor Canal-Mound. The irrigation system has been designed to allow for automatic watering with a manual override to stop or start watering. The system will use untreated groundwater in the ANL-W fire suppression system as the water source and have all distribution lines originating in a centralized location near the ANL-W Cooling Tower. (A schematic of the irrigation system that includes the chemical injection system and automatic valves is shown in Appendix A). The plan map (Appendix A) shows the location and specifications of the irrigation system for Interceptor Canal-Mound. The distribution line will extend over the Interceptor Canal-Canal using an old bridge structure that consists of two vehicle barriers that support a 14 in. I-beam. This bridge was used to rout a

12 in. water line across the Interceptor Canal after the range fires of 1995. The distribution line will run across the north side of the Interceptor Canal Mound and a 90^0 elbow will be used at the northwest corner to continue running the distribution line along the west side of the mound. Typical daytime winds are from the southwest and this design will allow for minimal wind-drift losses and allow full sprinkler coverage across the 40 ft width. The irrigation heads used will be commercially available from commercial irrigation systems and consist of oil-filled wind-fighter nozzles designed by Nelson to water 360^0. A small orange "road guard" will be attached to the sprinkler head to convert the 360^0 head into a 180^0 sprinkler head. The heads will be placed on risers so the spray will be above the tops of the fully grown koshia plants. To prevent the irrigation line from tipping, the risers will be attached to a fence-post stake that is driven into the ground approximately 14 in.. Nelson 30-lb pressure regulators will be used below each sprinkler head to keep water rates consistent between each irrigation head. Each head will be spaced 20 ft apart to allow for double coverage of the water using the 40 ft spray heads. The irrigation line will be a commercially available standard 3 in. aluminum sprinkler line that will be coupled together using ring-locks, which will keep the pipe joints from uncoupling when lines expand and contract due to the temperature changes. The distribution line will be slightly trenched into the ditch bank to minimize rotational movement and reduce the tripping hazard.

7.4.5 Barrier Installation

The Interceptor Canal-Mound site is located outside the ANL-W double security fence, as shown in Appendix A. The site is being remediated because of unacceptable risks to humans from cesium-137. The Interceptor Canal-Mound does not pose unacceptable risks to the ecological receptors. Thus,during phytoremediation of the Interceptor Canal-Mound site, preventive measures will need to be taken to prevent human exposure to cesium-137. Special ecological barriers will not be necessary, since there are no unacceptable risks to the ecological receptors. Signs will be placed on fence posts spaced approximately every 50 ft around the outside of the clear zone surrounding the Interceptor Canal-Mound; they will identify the area as a CERCLA site undergoing phytoremediation and identify a point of contact.

7.5 Planting Activities

This site will be planted using a broadcast spreader to distribute the seeds in the approximate pattern shown in Appendix A. The optimal spacing of the koshia was determined to be approximately 4 in. on center. This small spacing will increase the number of contaminant-soil-root contact points, stress the plants into going to seed earlier, and optimize the biomass of the koshia harvested each year. The approximate 4 in. spacing of the koshia plants will be accomplished by taking the 20,000 ft^2 surface area and dividing it by the seeds needed per square foot. The number of seeds needed will be increased by 10 % to account for those plants that will not germinate. The weight of the seeds needed will be determined by taking the number of seeds needed and dividing that number by 700,000 koshia seeds per pound. ANL-W has determined that for each crop, only 0.75 lb of seeds are needed for the 620,000 plants.

The Interceptor Canal-Mound soil will be prepared prior to planting using a ripper to loosen the soil to approximately 20 in. deep. A plow will then be used to turn over the soil and further enhance the air to soil contact. A rototiller will then be used to prepare the seed bed prior to planting. A local hydro seeding company will be contracted to apply the koshia seeds with nutrients and a tackifier over the Interceptor-Canal-Mound site. The tank on the hydroseed truck will be filled with one-half the volume of water necessary to hydroseed the entire mound area. The water will be collected from a water truck filling station located in the ANL-W parking lot. The cellulose, nutrients and koshia seeds will be added and mixed into the slurry, the remaining water will be added. The mixture will be mixed for an additional ten minutes and the truck will be driven to the Interceptor Canal-Mound site. The koshia will then be applied over the site, the areas that have been seeded will be viably distinguishable from the unseeded areas because of the dye in the cellulose material. After an even application of the koshia seed over the entire area the truck will be driven back to the tanker truck fill area of the parking lot and water will be added to the tank. The truck will be driven back to the Interceptor Canal Mound site and the truck will apply all of the water to the site. This will be conducted to flush any remaining koshia seed from the hydroseeding truck. The area will be watered every day (in manual mode) until the kohsia plant roots are established and can sustain an increase in water supply.

7.6 Irrigation and Amendments

To optimize the biomass of the koshia plants growing in the Interceptor Canal-Mound soils, supplemental irrigation will be installed to keep the soil moisture content between 40-50 % in the contaminated zone. Calibration of the moisture detectors along with the moisture content set point adjustments will be made in the field with the ANL-W soils. The system can be adjusted to optimize the moisture content needed by the plants to the actual site being remediated. To accomplish on demand watering, moisture detectors will be installed that will automatically turn on or shut off the irrigation system when the soil moisture varies outside these levels. Two moisture detectors will be stacked vertically at depths of 1.5 and 2.0 ft. An automatic watering switch will be installed on the detector located at the 1.5 foot depth. This will "train" the koshia roots to stay within the contaminated zone as they seek out water. The lower moisture detector will be used to verify that irrigation has not flushed the contaminants below the contaminated zone.

Appendix A contains a schematic of the zonal-type irrigation system that will be employed at ANL-W. The system will allow each of the remedial sites at ANL-W to operate individually based on its individual water needs. The system can be manually overridden if it is determined that more or less water is required for an individual site. As shown in Appendix A, a chemical injection system has also been installed prior to each of the zonal distribution lines. This will allow ANL-W to add soil ammendments [such as fertilizers and or extractants (EDTA and/or citric acid)] to each of the waste sites through the irrigation system. Chemical injection system will only be operated after the root zone fully covers the contaminated area and then only in manual mode. Further leachate tests are being conducted to further refine the concentration of extractants used in the bench-scale testing to maximize the leachability of the contaminants. Nutrient analysis of the soils will be tested periodically and the necessary fertilizers will be applied to meet the needs of the plants through their growing season. The extractant concentrations are also being tested to ensure the concentrations that optimize the leachability are not toxic to plants.

7.7 Harvesting Activities

The koshia will be harvested as soon as the first flowers on the plants are evident, which will prevent seeds from developing and prevent the release of koshia seeds across the INEEL. The koshia harvest will be accomplished by first reducing the moisture of the soil to less than 30%. The moisture detectors in the soil will then be manually removed from the soil. The irrigation system will then be manually operated for 5 minutes. This will wet the area and act as a dust suppressant while harvesting activities are being conducted.

Koshia harvesting will be completed using a commercially-available, walk-behind cycle mower, which has a 4 ft wide mowing bar that will cut the koshia approximately 2 in. above the ground. The koshia will fall in the opposite direction that the mower is operating and lay fairly flat against the ground. The koshia will be allowed to dry in place until moisture content is approximately 20%. The koshia will then be raked into windrows using a commercial hay rake. The koshia will continue to dry until the moisture content is approximately 15% and ready to bale. The baling will be completed using a commercial hay baler that produces rectangularly tied bales approximately 18 x 20 x 40 in. in size. The bailer will operate behind a large, Case-2290 tractor and the bale will be surveyed, loaded onto a small utility trailer, and moved to a staging area inside the ANL-W facility. After the bailing is completed a two-row potato digger will be used behind the Case 2290 tractor to lift the roots to the surface. When all roots have been lifted from the Interceptor Canal-Mound site, the rake will be used to pile the roots to the west end of the Mound. The roots will remain in the windrow on the west side of the Interceptor Canal-Mound until the moisture content is low enough to bale (approximately 15%). The Interceptor Canal-Mound will then be prepared for the second planting, using the rototiller, as soon as the first-crop roots have been removed. The planting sequence, along with any improvements and lessons learned from the first planting will be utilized for the second planting. Harvesting activities for the second crop will follow plans outlined for the first crop, in addition to implementing any lessons learned.

7.8 Postharvesting Activities

After each field season, postharvesting activities will be initiated that includes regrading the soils back toorigina- preplanting cross-sectional requirements (as shown in Appendix A). The koshia seeds for the first crop the following year will be planted in the fall and covered with a thin layer of water. The koshia will then be able to sprout and grow as soon as site conditions warrant. This will increase the growing season for the second year of the field test and increase the biomass of the koshia produced. The irrigation line will be turned off at the fire hydrant and the distribution line pressurized to 50 psi using a portable Sulair air compressor. Each of the distribution lines will be manually activated to blow the water from the irrigation line. This will be completed for each distribution line to prevent water from breaking lines during the winter.

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8 ANL-35 INDUSTRIAL WASTE LIFT STATION DISCHARGE DITCH

This section discusses information specific to release site Industrial Waste Lift Station Discharge Ditch and the work that will be performed during the 2-year phytoremediation field test. The necessary work has been subdivided into major tasks associated with preplanting, planting, irrigation, harvesting, and postharvesting activities specific to the Industrial Waste Lift Station Discharge Ditch. Generic activities that are common to all sites being remediatied at ANL-W (such as the Health and Safety Plan and the Quality Assurance Project Plan) can be found in the appendices.

8.1 History of Site

The location of the Industrial Waste Lift Station Discharge Ditch is shown in Figure 1-3. The Industrial Waste Lift Station Discharge Ditch, also known as the North Ditch, is located inside the ANL-W security fences. The ditch is approximately 500 foot long with a bottom width of 3 to 4 foot. At any one time, there is approximately 2 to 3 in. of standing water in the ditch from the 2-5 gpm discharge. The ditch receives industrial waste water, primarily cooling water, photo processing wastes (e.g., photo developers, fixers, stabilizers, and acids), and overflows from several retention tank that may contain ethanol, sodium hydroxide, and some radionuclides from a variety of ANL-W facilities. The ongoing and future discharges of these processing wastes (such as hazardous constitutents/corrosives) are regulated under RCRA, CERCLA will still regulate radionuclide releases. The cleanup action specified in this ROD addresses only past releases of these processing wastes and those contaminants in the Industrial Waste Lift Station Discharge Ditch.

8.2 Contaminants

Soil samples were collected from this site on three separate occasions—by DOE in 1989, Chen Northern in 1988, and by ANL-W in 1994. Data from the three studies were combined into one data set and organized according to the analytes that were collected (i.e., organics, inorganics, radionuclides, and dioxin/furans). Appendix A of OU 9-04 *Comprehensive RI/FS* shows the sampling location plan map, color-intensity profile maps, and statistics for COC (by pathway) for all samples that were collected.

Risk assessment results indicate there are no contaminants that pose unacceptable risks to humans and only one contaminant (silver) that has unacceptable risks to ecological receptors. All three studies were analyzed for silver which was detected at 87% (33 of 39) of the sample locations, with the highest detection (352 mg/kg) at #41. (Sample location #41 is located in the middle of the ditch.) The maximum concentration was used in risk assessment of the UCL value because of the small data set and large standard deviation in the data. However, since high concentrations were also detected at other locations (grid 18, ND03, 15, 18, and 19) the horizontal extent of contamination was defined as the entire length of the ditch. No trends on the vertical extent of contamination were detected for silver. The average soil depth on top of the basalt (1.0 ft) was used to define the vertical extent of contamination. Thus, the extent of contamination at the Industrial Waste Lift Station Discharge Ditch is defined as 15 × 500 × 1 ft.

8.3 Remediation Goal

The established remediation goal for silver in the Industrial Waste Lift Station Discharge Ditch is identified in the WAG 9 ROD as 112 mg/kg, which is calculated at 10 times the INEEL background concentration for silver.

8.4 Preplanting Activities

Preplanting activities will occur prior to the initial growing season at the Industrial Waste Lift Station Discharge Ditch and involve grubbing of currently existing vegetation (cattails and reeds), grading of the side slopes, removing rock, installing of irrigation lines, and signs (where necessary). Each of these activities specific to the Industrial Waste Lift Station Discharge Ditch are discussed below in further detail.

8.4.1 Grubbing Activities

The Industrial Waste Lift Station Discharge Ditch currently contains standing and free-flowing water that is discharged continuously throughout the year. The continuous supply of water has created a small ecological habitat area because of the nonnative cattails and reeds growing in the Industrial Waste Lift Station Discharge Ditch. These cattails and reeds must be extracted during preparation of the Industrial Waste Lift Station Discharge Ditch for phytoremediation. The plants will be excavated using a backhoe and the plant matter that is removed will be surveyed, sampled, and disposed of in accordance with RRWAC guidance for soils.

8.4.2 Grading Activities

The Industrial Waste Lift Station Discharge Ditch is currently used to transport relatively small amounts of water (2-5 gpm) and periodic blowdown discharges from the HFEF auxiliary cooling tower. The water in the Industrial Waste Lift Station Discharge Ditch follows the very lowest portion of the ditch and infiltrates into the soil before reaching the end of its' 500 ft length. The Industrial Waste Lift Station Discharge Ditch currently contains rebar with caps that identifies the 1994 sampling locations. A global positioning system will be used to permently identify these past sample locations. A small front-end loader will be used to slope where applicable at approximately a three-for-one foot grade to allow for equipment access. One man bridge and two vehicle bridges currently cross the Industrial Waste Lift Station Discharge Ditch that will impede the work and grading activities being conducted. In addition, computer control lines, electrical lines, and two industrial waste water discharge pipes will limit the grading activities around the man bridge area. (A cross sectional view of what the Industrial Waste Lift Station Discharge Ditch will look like after the grading is complete is shown in Appendix A).

8.4.3 Rock Removal

Any rock that is bigger than a cobble (2-3 in.) will be removed manually using a steel rake prior to planting. These rocks are not native to this area and have been used as ground cover over the open areas. Over time, the rocks have been dislodged and are now located in the ditch bottom. The rocks will not have any contamination on their outer surfaces and will be placed on the outer edges of the ditch banks.

8.4.4 Irrigation Line Installation

The Industrial Waste Lift Station Discharge Ditch will require additional water to fully optimize the removal efficiencies of the willow. To accomplish this, ANL-W will use supplemental irrigation to water the Industrial Waste Lift Station Discharge Ditch. The irrigation system has been designed to allow for automatic, on-demand watering with a manual override to stop or start watering. The system will use untreated groundwater in the ANL-W Fire Suppression System as the water source and will have all distribution lines originating in a centralized location near the ANL-W Cooling Tower. (A schematic of the distribution system is shown in Appendix A). The plan map of the Industrial Waste Lift Station Discharge Ditch (in Appendix A) shows the location and specifications of the irrigation system. The distribution line will be located on the top of the south ditch bank and run parallel to the Industrial Waste Lift Station Discharge Ditch. This will allow for minimal wind-drift losses from the typical southwesterly winds. The irrigation heads used will be commerciall-available home sprinkler lines and be fully adjustable from 0-335^0 with a range of 20 ft. The heads will be placed on riser tubes that are supported using fence posts. Each of the sprinkler heads will have a Nelson 30 pound pressure regulators to keep water rates consistent between each irrigation head in the distribution line. Each head will be spaced 10 ft apart to allow for double coverage of the water. The irrigation line will be a commercially-available 2-in. poly lineand will be slightly trenched into the ditch bank to minimize rotational movement and reduce the tripping hazard.

8.4.5 Barrier Installation

The Industrial Waste Lift Station Discharge Ditch is located inside the ANL-W, which is surrounded by a double security fence. Additional fencing around this site is not necessary to prevent human intrudance. Signs will be placed on fences around the Industrial Waste Discharge Ditch that identify the area as a CERCLA site undergoing phytoremediation and identify a point of contact. The signs will be placed approximately every 50 ft along the ditch banks. The only unacceptable risk this site poses is to ecological receptors; in this case, the receptors are plants not animals. No ecological fencing is needed to prevent plants from growing in the Industrial Waste Lift Station Discharge Ditch.

8.5 Planting Activities

This site will be planted with 3 ft tall, bare-root willow plants in a grid pattern (shown in Appendix A). The bare-root willow will be spaced approximately 18 in. on center to optimize the biomass of the plant at the end of the field season. The holes for the trees will either be made manually using a spade or hydraulically driven auger mounted on a boom. The holes will be excavated to approximately 12 in. into the soil to allow for complete planing of the willow roots. The soils will be placed back into the hole and lightly tampped. Water will be added to allow for settling of soil around the roots and to reduce the amount of void space. This procedure will be repeated until all willows have been planted in accordance with the plan map (shown in Appendix A). Where the tractor can not reach a planting location, a willow will be manually planted using a shovel to dig the hole.

If subsurface rock is encountered, the location of the willow can be moved toward the center of the ditch as the center of the ditch contains the contamination. Keeping the plants closest to the center will maximize the potential for contaminant removal. It is important to try to complete the planting as close as possible to the grid to limit the potential to stunt growth of the plants, which will reduce the biomass produced and ultimately the contaminant removals.

If basalt is encountered before the planting depth of 14 in. is reached, the plant can still be planted as long as the soil is deeper than 6 in.. A larger hole may have to be manually dug to allow the root ball to be spiraled into the hole. If the soil is less than 6 in. deep, the next grid location will be planted.

8.6 Irrigation and Amendments

To optimize the biomass of the willow plants, supplemental irrigation will be installed to keep the soil moisture content between 40-50 % in the contaminated zone. Calibration of the moisture detectors along with the moisture content set point adjustments will be made in the field with the ANL-W soils. The system can be adjusted to optimize the moisture content needed by the plants to the actual site being remediated. To accomplish this, moisture detectors will be installed that will automatically turn on or shut off the irrigation system when the soil moisture varies outside these levels. Two moisture detectors will be stacked vertically at depths of 1.0 and 1.5 ft. An automatic watering switch will be installed on the detector located at the 1.0 foot depth. This will "train" the willow plant roots to stay within the contaminated zone as they seek out water. The lower moisture detector will be used to verify that the irrigation has not leached the contaminants below the contaminated zone.

Appendix A shows the schematic of the zonaltype irrigation system that will be employed at ANL-W. The system will allow each of the remedial sites at ANL-W to operate individually, based on individual water needs. The system can be manually overridden if it is determined that more or less water is required for an individual site. As shown in Appendix A, a chemical injection system has been installed prior to the manifold distribution lines. This will allow ANL-W to add soil amendments [such as fertilizers and or extractants (EDTA and/or citric acid)] to each of the waste sites through the irrigation system. The chemical injection system will only be operated after the root zone fully covers the contaminated area and then only in a the manual mode. Optimum extractant concentrations tests are currently being conducted to increase the leach ability of the contaminants. Nutrient analysis of the soils will be tested periodically and the necessary fertilizers will be applied to meet the needs of the plants through their growing season. After these extractant concentrations are determined, they will be tested on the willow plants to determine if they are toxic to the plant.

8.7 Harvesting Activities

Willow harvesting will be accomplished by first reducing the moisture of the soil to less than 30%. The moisture detectors in the soil will then be manually removed. The irrigation system will then be manually operated for 5 minutes. This will wet the area and act as a dust suppressant while harvesting activities are being conducted.

Willow harvesting in the Industrial Waste Lift Station Discharge Ditch will be accomplished using a front-end loader mounted on a small tractor. A hydraulically-controlled implement will be installed on the front-end loader. The tractor will drive down the ditch and as the trunks of trees get wedged into the attachment, the loader can be raised to remove the tree root from the ground. Once the root is removed from the soil, the operator will then use the hydraulic ram to cut the willow trunk into two pieces. Another worker will take the two portions of the plant and feed them into the wood chipper. The chipped pieces of wood will then funnel into 2 ft^2 cardboard boxes. When the boxes are full, they will be labeled and surveyed and then staged in a cargo container to await shipment to the WERF incinerator. This process will continue until all willow plants have been removed from the soil.

8.8 PostHarvesting Activities

After all willow plants in the Industrial Waste Lift Station Discharge Ditch have been harvested, postharvesting activities will be initiated, which includes regrading of the soil back to the original preplanting cross sectional requirements, as shown in Appendix A. The irrigation line will be turned off at the fire hydrant and the distribution line will be pressurized to 50 psi using a portable Sulair air compressor. Each distribution line will be manually activated to blow the water from the irrigation line. This will be completed for each distribution line to prevent water from breaking lines during the winter.

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9 ANL-01 INDUSTRIAL WASTE POND

This section discusses information specific to the Industrial Waste Pond and the work that will be performed during remediation. The activities described in this section will only be initiated after the Industrial Waste Pond has completed its useful life (approximately 2002). This section has been prepared for use in the event that discharge rates to the Industrial Waste Pond decrease drastically and allow for implementation of phytoremediation during the 2-year field test. The information contained in this section will only be used if successful phytoremediation was demonstrated during the field test for similar contaminants in other ANL-W areas.

The necessary work for phytoremediation of the Industrial Waste Pond has been subdivided into major tasks associated with preplanting, planting, irrigation, harvesting, and postharvesting-activities. Generic activities that are common to all sites being remediated at ANL-W (such as the Health and Safety Plan and the Quality Assurance Project Plan) can be found in the appendices.

9.1 History of Site

The location of the Industrial Waste Pond is shown in Figure 1-3. The Industrial Waste Pond is an unlined, approximately 1.2-ha (3-acre) evaporative seepage pond fed by the Interceptor Canal and site drainage ditches. The pond was excavated in 1959, obtained a maximum water depth of about 4 m (13 ft) in 1988, and is still in use today. The Industrial Waste Pond was originally included with the Main Cooling Tower Blowdown Ditch (ANL-01A) as a Land Disposal Unit under the RCRA COCA on the basis of potentially-corrosive liquid wastes discharged from the cooling tower effluent. However, ANL-W conducted a field demonstration with the EPA and State of Idaho representatives in attendance in July 1988 that showed that any potentially corrosive wastes discharged to the Industrial Waste Pond were naturally neutralized in the Main Cooling Tower Blowdown Ditch before reaching the Industrial Waste Pond. On that basis, EPA removed the Industrial Waste Pond as a Land Disposal Unit and redesignated it as a Solid Waste Management Unit. Therefore, this site is still under the regulatory authority of RCRA, in addition to being on the FFA/CO and under the regulatory authority of CERCLA.

DOE anticipates that the Industrial Waste Pond will continue to be used for storm water disposal, as well as future releases of cooling water discharges from the SPF. SPF cooling water discharges will average 100 gpm and are anticipated to last for three years starting in the spring of 1998 and lasting until summer of 2002. These cooling water releases will be discharged to the surface drainage ditch on the North side of ANL-W and drain approximately 250 ft west to the Industrial Waste Pond. (SPF is a permitted HWMA/RCRA facility and is scheduled for clean closure under RCRA.)

9.2 Contaminants

Appendix A of *OU 9-04 Comprehensive RI/FS* shows the sampling location plan map and the statistics for COC (by pathway) for all samples collected from the Industrial Waste Pond. Soil and sediment samples were collected from the Industrial Waste Pond as part of four different investigations occurring from 1986 to 1994. Cesium-137 poses unacceptable risks for humans while, four inorganic contaminants were retained because they pose unacceptable risks to ecological receptors.

Cesium-137 and the four inorganics (trivalent chromium, mercury, selenium, and zinc) are present in the southern and eastern part of the Industrial Waste Pond with concentrations typically greatest for surface samples near the inlet pipe in the southern part of the Industrial Waste Pond. Samples were screened against the 95% UCL concentrations for grab samples at the INEEL and will be referred to as 95% UCL background. The highest number of metals above the 95% UCL background concentration were collected from location #101 with 11 metals exceeding background; location # 97 was next with 10 metals exceeding the 95% UCL background concentration. The maximum cesium-137 concentration was 57.91 pCi/g, while the 95% UCL concentration was 29.2 pCi/g. For the trivalent chromium, mercury, selenium, and zinc, the maximum concentrations were 11,400, 6.8, 37.9, and 5,850 mg/kg and the UCL values were 10,300, 2.62, 8.41, and 8.41 mg/kg, respectively. The horizontal extent of contamination is the dimensions of both the southern and eastern parts of the Industrial Waste Pond (200 ft wide and 250 ft long); the vertical extent of contamination is in the upper 0.5 ft of sediments in the Industrial Waste Pond.

9.3 Remediation Goal

The established remediation goal for the cesium-137 is 23.3 pCi/g based on a current activity level (i.e., the level to which the activity will decay to acceptable levels after 100 years). Because the cesium-137 will remain at activity levels that will limit its land use, the Industrial Waste Pond will require institutional controls and follow the O&M Plan (shown in Appendix B). The four inorganics that pose unacceptable ecological risks have remediation goals established in the ROD as being 10 times the INEEL background concentrations. Thus, the chromium, mercury, selenium, and zinc remediation goal concentrations are 500, 0.74, 3.4, and 2,200 mg/kg, respectively.

9.4 Preplanting Activities

Preplanting activities will occur prior to the initial growing season at the Industrial Waste Pond and involve grubbing of currently existing vegetation, grading, removing rock, and installation of irrigation lines, fences, and signs (where necessary). Each of these activities specific to the Industrial Waste Pond are discussed below in further detail.

9.4.1 Grubbing Activities

The Industrial Waste Pond currently contains relatively few weeds growing around its' perimeter. These plants have been able to extend their range into the Industrial Waste Pond because of the low water levels over the past four years. An area further in from these newly-developed weeds contains dead cattail and reed-type plants that were growing in water up to 30-in. deep. The water levels are too low to sustain these plants and only the old-plant stalks and roots remain. All of these weeds will be removed, surveyed, sampled, and disposed of in the appropriate INEEL location in accordance with the RRWAC.

9.4.2 Grading Activities

The Industrial Waste Pond is currently used for surface-water and storm water disposal. The north, south, and west sides are gently sloping and the bottom is relatively flat. Minimal grading would be required in order to facilitate phytoremediation. A berm area would be added in the Interceptor Canal to limit the surface water runoff to the Industrial Waste Pond to only major runoff events. This will prevent the plants from drowning. The cross-sectional view of the Industrial Waste Pond is shown in Appendix A.

9.4.3 Rock Removal

Any rock that is bigger than a cobble (2-3 in.) will be removed prior to planting. This work will be conducted manually using a utility trailer to transport the rocks. The rocks will not have any contamination on their outer surfaces and will be placed on the outer edges of the Industrial Waste Pond.

9.4.4 Irrigation-Line Installation

The Industrial Waste Pond phytoremediation will require additional water to fully optimize the removal efficiencies of the willow. To accomplish this, ANL-W will use supplemental irrigation to water. The irrigation system has been designed to allow for automatic watering with a manual override to either stop or start watering. The system will use untreated groundwater in the ANL-W Fire Suppression System as the water source and have all distribution lines originating in a centralized location near the ANL-W Cooling Tower. (A schematic of the irrigation distribution system is shown in Appendix A.) The plan map of the Industrial Waste Pond shows the location and specifications for the irrigation system that will be installed at the Industrial Waste Pond. The distribution lines will be located on top of the south and west ditch banks. This will allow for minimal wind-drift losses from typical southwesterly winds. The irrigation heads used are commercially available for farmers and spray in full circles with a 40 ft radius. The heads will be placed on risers that will be attached to fence posts to prevent tipping. Each riser will have a Nelson 30-lb pressure regulator attached to the top to keep water rates consistent between each irrigation head. The irrigation heads will be attached to the pressure regulators and will be spaced 40 ft apart to allow for double coverage with each head. The irrigation line will be a commercially available, 4-in. aluminum irrigation pipe. The irrigation line will be slightly trenched into the soil to minimize rotational movement and reduce the tripping hazard.

9.4.5 Barrier Installation

The Industrial Waste Pond site is located outside the area controlled by the ANL-W double security fences. Signs will be placed on the fences around the Industrial Waste Pond, identifying the area as a CERCLA site undergoing phytoremediation and a point of contact. These signs will be placed approximately every 50 ft along the outer edges of the Industrial Waste Pond and will minimize the potential for inadvertent human entrance into the Industrial Waste Pond site. A minor human intrudance will not pose an unacceptable human risk because the unacceptable risks to human receptors was for a minimum exposure of 8 hr. a day for 20 years. The ecological receptors for chromium, mercury, selenium, and zinc are the plants, merriams shrew, merriams shrew, and red-winged blackbird, respectively. The small localized population exposure to these sites during the phytoremediation activities will not have any detrimental effect to the population of these animals on the INEEL, Eastern Idaho, or Idaho.

9.5 Planting Activities

This site will be planted with 3-ft tall bare-root willow plants in a grid pattern (shown in Appendix A). The bare-root willows will be spaced approximately 18 in. on center to optimize the biomass of the plant at the end of the field season. The holes for the trees will either be made manually using a spade or hydraulically driven auger mounted on a boom. The holes will be excavated to approximately 12 in. into the soil to allow for complete planing of the willow roots. The soils will be placed back into the hole and lightly tampped. Water will be added to allow for settling of soil around the roots and to reduce the amount of void space. This procedure will be repeated until all plants have been planted in accordance with the plan map as shown in Appendix A. Where the tractor can not reach a planting location a willow will be manually planted using a shovel to dig the hole.

If subsurface rock is encountered, the location of the willow can be moved toward the center of the ditch. The center of the ditch contains the contamination; keeping the plants closest to the center will maximize the potential for contaminant removal. It is important to try to complete the planting as close as possible to the grid to limit the potential to stunt plant growth, which will reduce the biomass produced and ultimately the contaminant removals.

If basalt is encountered before the planting depth of 14 in. is reached, the plant can still be planted as long as the soil is deeper than 6 in.. A larger hole may have to be manually dug to allow the root ball to be spiraled into the hole. If the soil is less than 6 in. deep, the next grid location will be planted.

9.6 Irrigation and Amendments

To optimize the biomass of the willow plants, supplemental irrigation will be installed to keep the soil moisture content between 40-50 % in the contaminated zone. Calibration of the moisture detectors along with the moisture content set point adjustments will be made in the field with the ANL-W soils. The system can be adjusted to optimize the moisture content needed by the plants to the actual site being remediated. To accomplish this, moisture detectors will be installed that will automatically turn on or shut off the irrigation system when the soil moisture varies outside these levels. Two moisture detectors will be stacked vertically at depths of 1.0 and 1.5 ft. An automatic watering switch will be installed on the detector located at the 1.0 ft depth. This will "train" the willow plant roots to stay within the contaminated zone as they seek out the water. The lower moisture detector will be used to verify that no increase in soil moisture has occurred below the plant roots. In other words, ANL-W has not increased the leaching of these contaminants beyond the root layer.

Appendix A shows the schematic of the zonal-type irrigation system that will be employed at ANL-W. The system will allow each of the remedial sites at ANL-W to operate individually, based on individual water needs. The system can be manually overridden if it is determined that more or less water is required for an individual site. As shown in Appendix A, a chemical injection system has been installed prior to the manifold distribution lines. This will allow ANL-W to add soil amendments [such as fertilizers and or extractants (EDTA and/or citric acid)] to each of the waste sites through the irrigation system. Nutrient analysis of the soils will be tested periodically and the necessary fertilizers will be applied to meet the needs of the plants through their growing season. The chemical injection system will only be operated after the root zone fully covers the contaminated area and then only in the manual mode.

9.7 Harvesting Activities

Willow harvesting will be accomplished by first reducing the moisture of the soil to less than 30% moisture. The moisture detectectors in the soil will then be manually removed. The irrigation system will then be manually operated for 5 min. This will wet the area and act as a dust suppressant while harvesting activities are being conducted.

Willow harvesting will be accomplished using a front-end loader mounted on a small tractor. A hydraulically-controlled implement will be installed on the front-end loader. The tractor will drive down the ditch; and as the trunks of trees get wedged into the attachment, the loader can be raised to remove the tree root from the ground. Once the root is removed from the soil, the operator will then use the hydrualic ram to cut the willow trunk into two pieces. Another worker will take the root portions and feed them into the wood chipper. The chipped pieces of wood will then funnel into a 4 x 4 x 6 ft compactable box. When the box is full, the box will be labeled, surveryed, and staged in a cargo container, awaiting shipment to the WERF facility in accordance with the RRWAC. The top portion of the willow tree will be replanted into the Industrial Waste Pond. This process will continue until all willows have been removed from the soil.

9.8 Post Harvesting Activities

After all willow plants in the Industrial Waste Pond have been harvested, postharvesting activities will be initiated, which includes blowing out the irrigation lines to prevent them from freezing and bursting, turning off the irrigation line at the fire hydrant, and presuurizing the distribution line to 50 psi using portable Sulair air compresser. Each distribution line will be manually activated to blow any remaining water from the line to prevent the water from breaking the lines during the winter.

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10 REMEDIAL DESIGN PROJECT INFORMATION

This section addresses key remedial-action activities that will be performed—field oversight/construction management, project cost estimates, and schedules, inspections, prefinal inspection report, final inspection, institutional control plan, operations and maintenance plan, and five-year reviews.

10.1 Field Oversight/Construction Management

The DOE-CH Remediation Project Manager will be responsible for notifying the EPA and IDHW of project activities and serving as the single interface point for all routine contact between the Agencies. The ANL-W Project Engineer will be responsible for oversight of contractors, field work, project oversight, and disposal of harvested plant matter and excavated soils. An organizational chart and position description are provided in the HASP.

10.2 Project Cost Estimates

Project cost estimate are provided in Tables 10-1 and 10-2. The cost estimate for completing remediation at ANL-W (outlined in the work plan) has changed since the WAG 9 ROD. The obvious changes stem from use of the contingent remedy of excavation and on-INEEL disposal for two sites versus phytoremediation. This reduction is total surface area of the sites being remediated solely with phytoremediation has reduced cost savings associated with phytoremediaiton of a large surface-area site.

Table 10-1 shows the cost estimate for excavation and on-INEEL disposal of soils from the east portion of the Main Cooling Tower Blowdown Ditch and open portion of Ditch B. The costs include one-quarter full-time employee to oversee remediation activities. Other cost reductions involve decreases in costs of ecological receptor fencing, verification sampling, and the need for long-term monitoring. The costs for excavation and disposal for these two sites (approximately 100 yd^3) results in approximately a $1,000 per cubic-yard cost versus the estimated $350 per cubic yard identified in the ROD. The increase in cost per cubic yard of material being disposed of is based on the cost increase associated with the small volume of soil and the manual excavation of material on top of the basalt and around the culverts and roads inside the facility. If these sites were larger and the soil could easily be removed by heavy equipment, the costs would be much lower.

Table 10-2 shows the current cost estimate for the phytoremediation of Ditch A, west portion of the Main Cooling Tower Blowdown Ditch, Interceptor Canal-Mound, and Industrial Waste Lift Station Discharge Ditch. Again, a significant cost savings is not realized for these sites since the surface area of these sites is relatively small and spreadout which requires the use of manual labor. If the two large WAG 9 sites were remediated (Industrial Waste Pond and Sewage Lagoon), the costs per surface area would be greatly reduced. Table 10-2 shows current costs associated with the first year of the two-year field season and continued use of phytoremediation for five additional years. The use of phytoremediation is based on successful remediation of the cesium-137 taking six years (Table 3-1). As shown in Table 10-2, the cost of fencing was eliminated since it is not required for the koscia scoparia, since no animals or insects will eat it and contaminants removed by the hybred willow will not have a deterimental effect on the population of these animals on the INEEL, Eastern Idaho, or Idaho. Costs will be revised during each submittal of this document to reflect the most accurate cost estimates and known contractor quotes.

Table 10-1. Detailed Cost Summary Sheet for Excavation of 100 yd^3 with on-INEEL Disposal at the CFA landfill.

Cost Elements			Costs ($)
WAG 9 Management Costs			
CERCLA RD/RA Oversight	**Subtotal**		**$40,000**
Documentation Package			
Site surveying (GPS)		$	1,500
Verification Sampling Plan		$	0
Verification Sampling Costs		$	0
Safe Work Permit		$	3,500
Radiation Work Permit		$	3,500
Excavation Permit		$	3,500
Waste Acceptance Report to LMITCO		$	5,500
	Subtotal		**$17,500**
Construction Costs			
Mobilization and Demobilization		$	2,000
Soil Removal		$	25,000
Soil Transport to INEEL Repository		$	10,000
Tipping Fee/cy		$	0
Backfill Site to Grade		$	10,000
Revegetation		$	0
	Subtotal		**$47,000**
Operations and Maintenance Costs			
Postclosure Management		$	0
Monitoring		$	0
WAG 9, Five-year Reviews		$	0
	Subtotal		**$0**
Total in 1999 dollars		**$**	**104,500**

Table 10-2. Detailed Cost Summary Sheet for Phytoremediation of Four Sites.

Cost Elements			Costs ($)
WAG 9 Management Costs			
CERCLA RD/RA Oversight	**Subtotal**		**$528,259**
Documentation Package			
Site Surveying		$	8,400
Final Design Bid Package		$	7,000
Safety Analysis Report		$	8,750
Verification Sampling Plan		$	7,000
Verification Sampling Costs		$	21,000
Safe Work Permit		$	3,500
Radiation Work Permit		$	3,500
Excavation Permit		$	3,500
Waste Acceptance Reports to INEEL Contractor		$	35,000
	Subtotal		**$97,650**
Construction Costs			
Specialized Equipment Cost		$	200,000
Prepare Soil for Planting		$	4,000
Planting/Growing Season		$	40,000
Irrigating/Growing Season		$	8,000
Fertilizing/Extractants/Growing Season		$	1,500
Harvesting/Growing Season		$	10,000
Bailing/Growing Season		$	4,000
Analysis/Rad Surveys/Growing Season		$	12,000
Transport to INEEL WERF Incinerator/Season		$	14,000
Additional Five Years of Phytoremediation		$	542,478
Purchase and Installation of Warning Signs		$	5,000
Surface Water Diversion		$	0
	Subtotal		**$840,978**
Operations and Maintenance Costs			
Postclosure Management		$	203,125
Monitoring (total for next 20 years)*		$	239,200
WAG 9, Five-year Reviews (20 times)*		$	338,000
	Subtotal		**$780,325**
Total in 1999 dollars		**$**	**2,247,212**

* Costs are determined by taking the cost estimates for work performed in 1999 assuming a constant 5% annual inflation rate for future costs for work to be performed in years 2000 through 2098.

10.3 Project Schedule

The WAG 9 remedial action schedule is shown in Appendix F. It identifies the overall working schedule for WAG 9 implementation of the two-year field test of phytoremediation for four areas at ANL-W and excavation and disposal of soils from two sites at ANL-W. Individual working schedules from the remediation of each of these individual sites are also shown in Appendix F. After verification samples from the phytoremediation sites are collected, analyzed, validated, and evaluated, phytoremediation report will be written. A new working schedule will be written after the Agencies review the phytoremediation report and a determination has been made to continue with phytoremediation or use excavation with on-INEEL disposal remedy. The new working schedule will be ready in April 2001.

10.4 Inspections

At their discretion, agency project managers or their designees may inspect the site during the process to assess compliance with the remedial design and procedures outlined in the remedial-action work plan. DOE anticipates that, during the phytoremediation field season, personnel from the EPA or IDHW, whom are not associated with WAG 9, will want a tour of the process. These tours can be arranged by contacting the DOE ANL-W Field Office.

10.5 Prefinal Inspection

The prefinal inspection will be conducted by agency project managers or their designees prior to completing remediation. A checklist documenting the prefinal inspection will be developed and approved by the Agencies appoximately 3 weeks before the inspection. Action for resolution and on anticipated schedule for completion will be noted next to the outstanding items and documented on the prefinal inspection checklist. DOE-ARG will notify the Agencies approxmately 2 weeks prior to the prefinal inspection date.

After the prefinal inspection, the DOE-ARG Remediation Project Manager will be responsible for:

- Inspecting outstanding items after they are completed.
- Recording the date work was completed and inspected.
- Authorizing remedial-action activities to be completed.

10.6 Prefinal Inspection Report

Following the prefinal inspection, prefinal inspection report will be prepared and submitted to the EPA and IDHW as a secondary document. Although DOE-ARG will respond to the comments received from the EPA and IDHW, the prefinal inspection report will not be revised. Instead, comments will be finalized in the context of the remedial action report, a primary document, in accordance with Section 8.4 of the FFA/CO.

The prefinal inspection report wil include:

- Names of inspection participants

- Inspection checklist identifying project components that are not in compliance with the drawings or specifications
- Discussion of findings
- Corrective-action plans to correct deficiencies
- Operation and Maintenance Plan update
- Date of final inspection.

All outstanding construction requirements, along with the actions required to resolve those items, will be identified and approved by the Agencies during the prefinal inspection. The prefinal inspection report will then document any unresolved items and the effort required to resolve them.

10.7 Final Inspection

The final inspection will be conducted following demobilization (after all excess materials and nonessential construction equipment have been removed from the site). Some equipment may remain onsite to repair items observed during the final inspection., This fianl inspection conducted by the Agencies project managers or their designees will confirm the resolution of all outstanding items identified in the prefinal inspection and verify that OU 9-04 remedial action has been completed in accordance with the requirements of the ROD.

10.8 Remedial Action Report

The remedial action report will be prepared following demobilization and restoration of the site, and submitted to the Agencies as a primary document. The remedial action report will include:

- Identification of the work defined in the RDRA work plan and certification that work was performed.
- Explanation of any modifications to the RD/RA Work Plan.
- Any modifications made to the remedial design during the remedial action phase, including the purpose and results of any modifications.
- Problems encountered during the remedial action and resolutions to these problems.
- Any outstanding items from the prefinal inspection report that were identified and described. (In responding to comments received, the prefinal inspection report will not be revised, but rather will be finalized in the context of the remedial action report.)
- Certification that remedies are operational and functional and achieving the requirements of the ROD.
- Operation and Maintenance Plan update.
- Copy of waste acceptance sheets for ash and soil disposal.

- Final costs of the WAG 9-04 remediation costs.

- Final Inspection results. (Any final inspection will be documented in the draft remedial action report, submitted to the Agencies Project Managers within 60 calendar days of the final inspection, and used to resolve prefinal inspection issues.)

10.9 Operations and Maintanence Report

The O&M report will be used to formally document that the ROD remediation goals have been attained. The O&M report will also document what postremedial actions are required. These postremedial actions involve updating the O&M plan to incorporate any changes that have taken place since remedial action was completed, and complying with the ANL-W Institutional Control Plan and CERCLA five-year reviews. Details of the Institutional Control Plan and five-year reviews are discussed in the following two sections.

10.10 Institutional Control Plan

The Institutional Control Plan (ICP) for WAG 9 OU 9-04 at the INEEL has been written as a stand alone document. The ICP is included as Appendix H to this OU 9-04 Remedial Design.

10.11 Five-Year Reviews

In accordance with the NCP for sites where contamination is left in place at levels that are above risk-based levels for unlimited use, a review of the selected remedy will be conducted no less than every five-years until it is determined by the Agencies to be unnecessary. The five-year review will evaluate the remedy to determine if it is being protective of human health and the environment. For OU 9-04, three sites will need to be evaluated because ANL-W is only remediating the radionuclide concentrations of cesium-137 to levels that will decay to background levels after 100 years. DOE has determined that the most likely exposure scenario for ANL-W is for a residential receptor 100 years in the future (2097). Thus, the remediation goals were backcalculated using the concentrations of cesium-137 that would be acceptable for unrestricted use 100 years in the future. All other OU 9-04 sites have remediation goals for ecological receptors that once met will allow the land to be released for unrestricted use.

The three sites (Industrial Waste Pond, Interceptor Canal-Canal, and Interceptor Canal-Mound) that have cesium-137 remediation goals at levels that are above those allowed for unrestricted use will complete the following checklist and submit it to the Agencies for the first five-year review. After the checklist is reviewed, the Agencies will determine if the site warrants the next five-year review. This process will continue until the Agencies determine otherwise or the 100 year institutional control period is completed (2097). Table 10-3 shows the five-year checklist that DOE will submit to the Agencies for each of the three sites with contaminant levels that exceed those of an unlimited release.

Table 10-3 Five Year Review Checklist.

Task	Yes	No
Has an on site inspection been completed for all three sites?		
Are human residents living within 50 meters of the Industrial Waste Pond site?		
Are human residents living within 50 meters of the Interceptor Canal-Canal site?		
Are human residents living within 50 meters of the Interceptor Canal-Mound site?		
Are warning signs in place and still readable at the Industrial Waste Pond site?		
Are warning signs in place and still readable at the Interceptor Canal-Canal site?		
Are warning signs in place and still readable at the Interceptor Canal-Mound site?		
Are land-use restrictions for the Industrial Waste Pond recorded and available for inspection at the Bingham county courthouse?		
Are land-use restrictions for the Interceptor Canal-Canal recorded and available for inspection at the Bingham county courthouse?		
Are the land use restrictions for the Interceptor Canal-Mound recorded and available for inspection at the Bingham county courthouse?		
Were any air, soil, or groundwater samples collected? If yes, attach summary of results.		
Are there any construction or mining activities that threaten to encroach on or undermine any of the these three sites?		
Are the Institutional Controls (warning signs and land-use restrictions) at the Industrial Waste Pond site still protective?		
Are the Institutional Controls (warning signs and land-use restrictions) at the Interceptor Canal-Canal site still protective?		
Are the Institutional Controls (warning signs and land-use restrictions) at the Interceptor Canal-Mound site still protective?		
Are current photos of each site attached to this checklist?		
Is the current responsible federal agency contact person and their address identified and attached to this check list?		
Is a review needed prior to the next five year review?		
Schedule date for submittal of next five-year review		
Signature of engineer responsible for completing this review: ______________________	Date: ________	

11 INCORPORATION OF ARARs

Under CERCLA Section 121, response actions conducted entirely onsite are exempt from obtaining federal, state, or local permits. However, these actions must comply with the substantive aspects of the applicable or relevant and appropriate requirements (ARARs) specified for the site. Table 11-1 summarizes how the substantive requirements of the ARARs and the to-be-considered (TBC) requirements for the ANL-W sites that will undergo phytoremediation (Ditch A, West portion of the Main Cooling Tower Blowdown Ditch, Interceptor Canal-Mound, and Industrial Waste Lift Station Discharge Ditch) have been addressed by the remedial design or will be addressed during the remedial action. Table 11-2 summarizes how the substantive requirements of the ARARs and the TBC requirements for ANL-W sites that will undergo excavation and disposal (Ditch B, east portion of the Main Cooling Tower Blowdown Ditch) will be addressed during the remedial action. Additional discussion of the ARARs for the remedial actions is found in Section 9 of the WAG 9 ROD.

Two of the identified ARARs that are identified (for each remedial technology) require modeling prior to remedy implementation. These are air-emission calculations identified as 40 CFR 61.92 and IDAPA 16.01.01.585 and .586. The emission calculations are needed so they can be compared to the regulated concentrations prior to remedy implementation. If a remedy exceeds the regulated values, engineering controls can be implemented to reduce emissions to acceptable levels. Section 11.1 describes the details of the air-emission calculations that have been performed prior to implementation of selected remedies.

11.1 Air Emissions Calculations

Air emission calculations are needed to satisfy 40 CFR 61.92 for Emissions of Radionuclides Other than Radon from DOE facilities prior to implementation of the remedy. In addition, fugitive dust emissions of carcinogenic and noncarcinogenic contaminants are needed prior to initiating the remedy to satisfy IDAPA 16.01.01.585 and 586. The following two sections discuss (in detail) the assumptions used in modeling and the results of the air-emissions modeling.

11.1.1 Radionuclide Modeling

CAPP 88PC, an EPA-approved computer code, was used to calculate the possible radionuclide emissions to the nearest off-site receptor expousre level. This calculated exposure level was then compared to 40 CFR 61.92 for Emissions of Radionuclides Other than Radon limit of 10 mrem/year.

The Interceptor Canal-Canal site is the only site currently undergoing cleanup for radionuclides and that CAP88PC modeling was required for. As shown in the CAPP88PC modeling runs for the Interceptor Canal-Canal (shown in Appendix E), the exposure for cesium-137 and it's daughter barium 137M is only 7.38 E-05 mrem/year, well below the 10 mrem/year limit. (Appendix E contains the report on the CAP 88PC modeling.)

Table 11-1. Evaluation of ARARs and TBC for Sites Undergoing Phytoremediation.

ARAR Statute	Citation	Requirement(s)	Relevancy	Compliance Strategy
Action				
Idaho Fugitive Dust Emissions	IDAPA 16.01.01.650	To control dust during excavation/farming operations.	Applicable	An irrigation system will be installed so water can be applied to land disturbed by excavation and/or farming operations.
Idaho Hazardous Waste Management Act	IDAPA 16.01.05.005 (40 CFR 261)—"Identification and Listing of Hazardous Waste"	All plant materials will need to be sampled for hazardous materials prior to shipment to an incinerator.	Applicable	Plant-material samples will be collected and analyzed to determine if the plant matter is regulated hazardous waste.
Idaho Hazardous Waste Management Act	IDAPA 16.01.05.006 (40 CFR 262.11)—"Hazardous Waste Determination"	Any materials that could potentially contain hazardous constituents must be sampled using approved methods.	Applicable	ANL-W will conduct hazardous waste determinations for plants and soils leaving the WAG in accordance with the citation.
General Requirements for Shippers	49 CFR 173	DOE will have to comply with the requirements for packaging and transporting of radioactive and hazardous material to an incinerator.	Applicable	These packaging and transportation regulations will be met by placing the waste in an appropriate shipping container and applying the appropriate placards.
National Contingency Plan - Procedures for planning and implementing off-site response actions	40 CFR 300.440	The statute will apply if incinerated ash is a RCRA regulated hazardous waste and is shipped off-site for disposal.	Applicable	If determined to be a hazardous waste, the ash will be shipped off-site to a Subtitle C landfill, which is operated in compliance with RCRA. These activities will be conducted in accordance with Standard Operating Procedure TRP-WERF-3.2.5.3.
Chemical				
NESHAPS-Radionuclides other than Radon-222 and -220 at DOE facilities-Emission Standard	40 CFR 61.92	Limits the exposure of radioactive contaminant release to 10 mrem/year for the off-site receptors.	Applicable	CAPP 88PC modeling has been conducted that shows that the 10-mrem/year limit is not exceeded for radionuclide isotopes. Dust-control measures will also further reduce the actual releases from those that were determined through modeling.

Table 11-1. (Continued).

ARAR Statute	Citation	Requirement(s)	Relevancy	Compliance Strategy
Rules for the Control of Air Pollution in Idaho	IDAPA 16.01.01.585 and 586	Idaho rules governing the release and verification of carcinogenic and noncarcinogenic contaminants into the air.	Applicable	Calculations of the contaminants that would be released into the air from the remediation effort have been calculated and compared to the screening emission levels. As shown in Appendix E, none of the contaminant emission limits are exceeded.
Location				
Archeological and Historic Preservation Act	16 USC 470	This will be applicable if unexpected cultural artifacts are uncovered during excavation/farming operations.	Relevant and Appropriate	The areas at WAG 9 that will be remediated are less than 50 years old, man-made ditches and ponds, and have not been identified as having cultural significance. If cultural artifacts are encountered, DOE would stop work and conduct a detailed survey of the area.
To Be Considered				
Environmental Protection, Safety, and Health Protection Standards	DOE Order 440.1	DOE Orders for protecting workers.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environment, Safety, and Health Manual ensures safe remediation activities.
Radioactive Waste Management	DOE Order 5820.2A and 435.1 in FY 2000	DOE Orders provide guidance on disposal of low-level radioactive waste.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environment, Safety, and Health Manual and the Waste Handling Manual ensures safe packaging and disposal of low-level radioactive waste.
Radiation Protection of the Public and Environment	DOE Order 231.1	DOE Orders that provide guidance on radiological environmental protection and guidelines on cleanup of residual radioactive material prior to release of the property.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environment, Safety, and Health Manual ensures protection of the public and environment from radiological hazards.

Table 11-2. Evaluation of ARARs and TBC compliance for on-INEEL disposal of contaminated soils.

ARAR Statute	Citation	Requirement(s)	Relevancy	Compliance Strategy
Action				
Idaho Fugitive Dust Emissions	IDAPA 16.01.01.650	To control dust during excavation operations.	Applicable	Application of water and if needed chemical dust suppressants to land disturbed by excavation/trucking operations will limit the release of dust. The sites being excavated are wetted by surface water runoff and industrial water discharges.
General Requirements for Shippers	49 CFR 173	DOE will have to comply with the requirements for packaging and transporting of radioactive and hazardous material to on-INEEL disposal site.	Applicable	These packaging and transportation regulations will be met by placing the waste in appropriate shipping containers and applying the appropriate placards.
Chemical				
NESHAPS-Radionuclides other than Radon-222 and -220 at DOE facilities-Emission Standard	40 CFR 61.92	Limits the exposure of radioactive contaminant release to 10 mrem/year for the off-site receptors.	Applicable	CAPP 88PC modeling is not required for the soils in Ditch B and the Main Cooling Tower Blowdown Ditch since the radionuclides are at levels below those of INEEL background.
Rules for the Control of Air Pollution in Idaho	IDAPA 16.01.01.585 and 586	Idaho rules governing the release and verification of carcinogenic and noncarcinogenic contaminants into the air.	Applicable	Calculations of the contaminants that would be released into the air from the remediation effort have been calculated and compared to the screening emission levels. As shown in Appendix E, none of the contaminant emission limits are exceeded.

Table 11-2 (Continued).

ARAR Statute	Citation	Requirement(s)	Relevancy	Compliance Strategy
Location				
Archeological and Historic Preservation Act	16 USC 470	This will be applicable if unexpected cultural artifacts are uncovered during excavation operations.	Relevant and Appropriate	The areas at WAG 9 that will be remediated are less than 50 years old, man made ditches and ponds, and have not been identified as having cultural significance. If cultural artifacts are encountered, DOE will stop work and conduct a detailed survey of the area.
To Be Considered				
Environmental Protection, Safety, and Health Protection Standards	DOE Order 440.1	DOE Orders for protecting workers.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environment, Safety, and Health Manual ensures safe remediation activities.
Radioactive Waste Management	DOE Order 5820.2A and 435.1 in FY 2000	DOE Orders provide guidance on disposal of low-level radioactive waste.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environment, Safety, and Health Manual and the Waste Handling Manual ensures safe packaging and disposal of low-level radioactive waste.
Radiation Protection of the Public and Environment	DOE Order 231.1	DOE Orders that provide guidance on radiological environmental protection and guidelines on cleanup of residual radioactive material prior to release of the property.	To Be Considered	Worker compliance with Standard Operating Procedures specified in the DOE Order-based Environment, Safety, and Health Manual ensures protection of the public and environment from radiological hazards.

11.1.2 Fugitive Dust Emissions

Emissions of fugitive dust released during the remediation activities at ANL-W must be calculated and compared to the exposure limits specified in IDAPA Section 16.01.01.585 and .586. Section 585 identifies the exposure limits for non carcinogenic contaminants while Section 586 identifies the exposure limits for carcinogenic releases. The fugitive dust analysis consisted of dust emissions from heavy equipment operating in a contaminated site and the emissions from material excavation activities (i.e., dumping). The total emission was calculated by summing the individual emissions from the two sources for each particle size and then adding the five particle size emissions together. Appendix E contains the fugitive dust emission calculations for each site. All of the contaminants at the ANL-W sites are noncarcinogenic and the releases are orders of magnitude below the screening emission levels identified in 16.01.01.585.